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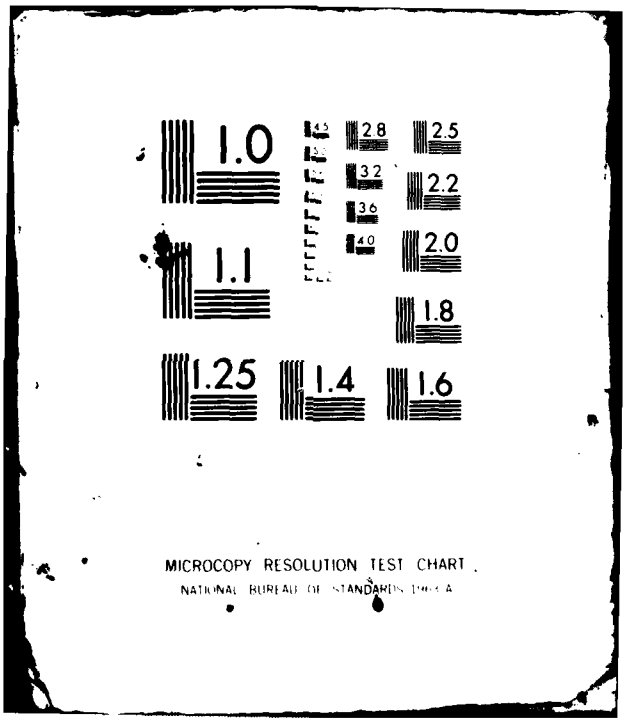
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FOREIGN TECHNOLOGY DIVISION

DANGEROUS ELECTRIC WAVES

by

Feng Xiancheng

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DANGEROUS ELECTRIC WAVES
by Feng Xiancheng

The fighting eagle* soars into the blue sky, enters a sea of clouds, and in a twinkling is shot down by an enemy aircraft, destroyed by the enemy stronghold ..... At still another battlefield, large numbers of aircraft are shot down by radar controlled weapons. For example, between 1964 and 1968, forty-eight aircraft of U. S. imperialists who invaded Viet Nam were shot down by fighters, 117 were shot down by SAM-2 air defense missiles, and 750 were shot down by various anti-aircraft guns. And again in the 1973 Mideast War, in less than 20 days, over 100 Israeli aircraft were shot down by Egyptian SAM-6 missiles and quad anti-aircraft guns. No matter if it is surface-to-air missiles, anti-aircraft guns or air-to-air missiles, nearly all are under the command and control of radar and electronic equipment. This controls the radar for firing the guns, generally called "fire control radar". Weapons controlled by fire control radar can not only automate aiming and firing, but the percentage of hits is very high. However, when operating, all must radiate radio waves of various frequencies at the target. In case an aircraft is detected by these waves, it can be destroyed in an instant. These are dangerous waves which threaten the existence of the aircraft.

In modern warfare, a group of combat aircraft can be irradiated and tracked by dozens, even hundreds, of kinds of radar waves, of

[* TRANSLATOR NOTE: A term used by Chinese meaning "fighter aircraft"].

which there are probably dozens of kinds of fire control radars in use for aiming and tracking against aircraft, and the aircraft are in danger. But if the aircraft is eqipped with modern electronic countermeasure equipment (ECM), it will promptly be able to detect and identify electric wave emitted by fire control radar as well as to make use of the electronic countermeasures, causing the enemy radar to be confused, commands to be paralyzed, weapons to be out of control, in order to destroy the enemy and preserve our own.

With respect to aircraft, the main fire control radars which constitute a threat are: surface-to-air missile guidance radar, anti-aircraft gun directing radar, air-to-air missile guidance radar and airborne intercept directing radar. These radars all have their own technical parameters, For example, carrier wave frequency, pulse width, pulse repetition frequency, antenna rotating speed and scanning method. And measuring these parameters, it is possible to determine the performance and use of the radar as well as the immediate mode of operation, the acquisition mode of searching for the target or the tracking mode in preparation for firing at a locked-on target. Normally, radar antennas in the acquisition mode scan a 360° circle and intermittently beam radar waves at the target; upon switching to the tracking mode, the radar waves are continuously beamed at the target. These are the dangerous waves. Once the airborne electronic reconnaissance equipment detects these dangerous waves, it at once alerts the pilot: a continuous red warning lamp comes on and a speaker or headphones emit short honking sounds. The danger is nearby and the pilot immediately goes into action: he either makes a course maneuver to avoid the danger area or drops passive countermeasure chaff (fibers); or activates active electronic jamming; or launches anti-radar missiles.

ANTI-AIRCRAFT "AMBUSH" WARFARE

In the fall of 1965, a Vietnamese air defense missile unit equipped by the unselfish aid of the Chinese people quietly deployed to a position in the vicinity of Haiphong. All radio communications and radar equipment conducted wave surveillance and maintained radio

silence. During the first two days, one by one a number of U. S. military aircraft came into missile firing range, but none of the missile guidance radars were turned on - and why was this? In the first place, they were U. S. electronic reconnaissance aircraft and their specialty is carrying out "fire power" reconnaissance prior to a bombing raid. If the radar is turned on, the airborne electronic reconnaissance equipment will be able to measure the parameters of the radar and discover the location of the air defense weapons and will be able to employ electronic jamming during the air raid. But in the closely guarded areas of these missiles it appeared that "all was well". As expected, on the evening of the third day, a large number of bombers escorted by fighters entered the circle of ambush of the surface-to-air missiles. One by one the enemy planes were "captured" by the guidance radar and one after another the missiles shot into the sky. The radio proximity fuses on the missiles detonated at some tens of meters from the aircraft. Several aircraft fell trailing dense smoke and the formation of U. S. aircraft was in chaos. The fighters abandoned the bombers. The bombers in reckless confusion dropped their bombs under very awkward conditions. The U. S. aircraft continued to be shot down. After 10 minutes or so, the ambush warfare was successfully concluded. Altogether, approximately 20 aircraft were shot down as shown in Figure 1.

The U. S. Air Force has suffered defeat and would carry out its usual practice of retaliation. Sure enough, the next day before dawn, several dozen U. S. Air Force aircraft at once seized upon the air defense missiles' weakpoint of lacking low-altitude capability and slipping in at low altitude, attempted to destroy the guided missile positions with one blow. But the missiles had all been moved during the night and in their place were instead radar controlled anti-aircraft guns with good low-altitude capability. The result was that more than 10 U. S. aircraft were shot down. After this, U. S. Phantom fighters and B-52 bombers were shot down continuously. As a result, the United States commenced implementation of the "Rapid Response Plan", developed guided missile warning reconnaissance systems, various electronic countermeasure pods, equipped

special purpose ECM aircraft, began employing "Shrike" anti-radar missiles and were able to bring about a reduction in aircraft losses. According to statistics, before acquiring countermeasures against the SAM-2 surface-to-air missiles, one aircraft was shot down for about every three missiles fired. But after adopting the countermeasures, one aircraft was shot down for every 80 missiles fired.

LIFE-AND-DEATH STRUGGLE

With respect to the aircraft which are detected by fire control radar, they are in danger sure enough, but these radar waves are neither very safe for the radat itself because an anti-radar missile will fly along the radar beam to the radar antenna and blow up the radar and its operators.

In late 1965, U. S. special-purpose Shrike missiles made surprise attacks on Vietnamese gun-directing radar and air defense missile radar and Shrike missiles carried by A-6 attack aircraft used electrical waves emitted by ground radar to perform radio passive homing guidance with a launch range of 40 kilometers and an armament load of 20 to 60 kilograms of high explosives. In the northern region of Viet Nam, a life-and-death struggle began between the gun-directing radar and the "Shrike" carrying aircraft. Whenever the radar would pick up an enemy aircraft but it was already too late to aim and fire the guns and with the Shrike missiles in a position of superiority flying along the beam toward the radar, a little delay would cause the radar and the people involved to be blown up. At this critical moment the radar operators suddenly shuts off the equipment or abruptly turns the antenna, the missile loses the guidance of the beam and the shot misses. One time, the radar had already picked up the aircraft and was at the point of aiming of aiming and firing when suddenly below the aircraft "blip" on the radar screen there appeared another small blip. Uh-oh! The "Shrike" had already been launched, but the operator, anxious to engage the enemy and not ready to give up an opportunity to shoot down an enemy aircraft, quickly aimed and fired four anti-aircraft gun volleys. The "Shrike", having already

gained speed, hit the radar first and the operator died a martyr at his post, but the enemy aircraft was also shot down (Fig. 2). Later an electronic memory circuit was added to the Shrike missile. Once launched, even if the radar were shut off, could still hit the target based on the original direction. It was necessary to cope with the improved Shrike and a method was adopted whereby two radars were turned on at the same time, causing the missile to hit between the two radars, or turning several radars on and off in sequence causing the missiles to make errors and lowering the Shrike missiles' percentage of hits.

SEA-TO-AIR ELECTRONIC WARFARE

In June 1967, Israel launched the Third Mideast War. Before the war, by means of airborne electronic reconnaissance, Israel had obtained Egypt's radar capabilities and blind areas and military intelligence on the deployment of missiles and aircraft. As soon as the war started, Israeli aircraft slipped into the radar blind areas at extremely low altitudes, avoided air-defense radar detection and suddenly appeared from the north of the Nile River delta over an Egyptian airfield on the banks of the Suez Canal. While conducting electronic suppression jamming against ground radio communications and radar, causing disrution of the communications of the Egyptians who did not have ECM capability, command control was paralyzed, radars were put out of commission and their aircraft could not be ordered to take-off and attack. Twenty air defense missile companies and over 100 missile launchers were not able to pick up the targets because the guidance radar had been jammed. As a result, within two hours nearly all of Egypt's aircraft, radars and missiles were destroyed. This time Israel's surprise attack succeeded. Electronic reconnaissance had taken on an extremely important function. But the battle at sea was another matter. When the Israeli destroyer, "Eitla" [sic] advanced on Port Said, Egyptian fast missile boats launched Styx anti-ship missiles. The guidance radar has already picked up and aimed at the enemy ship and the "Eitla" came to its end without the least forewarning. Four Styx missiles were launched

and four hits were made. The Israeli destroyer was attacked, hit, set fire, sunk, and "buried" at the bottom of the sea.

In the Fourth Mideast War in October 1973, the situation was reversed. Egypt had used the six year interval and had set up a 30 to 50 kilometer deep air defense zone along 180 miles of the Suez Canal and had deployed a large number of new type air defense weapons having good low-altitude capability. For example: the use of SAM-6 missiles with a new system of radar continuous-wave guidance and the use of infrared guided SAM-7 missiles equipped with a light filtering lens which can distinguish between aircraft exhaust and the heat rays of a tracer, therefore the jamming effect of infrared tracers is very little, and the use of "Gun Dish" radar controlled 23mm quad-mounted guns. Once the electric wave frequency spectra of these fire control radars has been exceeded, the United States supplied Israel with ECM capability. Because of this Israel failed to obtain information on new Soviet made air defencse weapons. The Israeli Air Force mastered air superiority but were in an inferior position in ECM. Within the first week after the war started, Israel lost 78 aircraft and nearly all were shot down by SAM-6's, SAM-7's, and quad-mounted anti-aircraft guns. Since the U. S. had ECM equipment against SAM-2's and SAM-3's as well as the "Shrike" anti-radar missile, therefore hardly any Israeli aircraft were shot down by SAM-2's and SAM-3's. But against the new fire control radars, Israel was neither able to reconnoiter nor to jam and as a result in less than 20 days (from 6 October to 24 October) over 100 Israeli aircraft were shot down by air defense weapons. Several reconnaissance satellites launched by the United States provided Israel with military intelligence on the Egyptian rear and as a result the Israeli army stole across the Suez Canal, attack Egyptian missile positions, captured several SAM-6 and SAM-7 missiles and regained the initiative.

In the sea war, 4 Israeli patrol craft engaged over 10 Syrian fast missile boats and since Israel had learned a lesson from the previous sea war failures, ECM was employed against the Styx missiles and before the Syrian ships could launch their missiles the Israelis

carried out electronic suppression jamming against their guidance radar. After the missiles were launched, fast-scattering chaf (jamming fibers) was dropped and they successfully avoided the attack of more than 10 Syrian speed boats and of the 50 missiles launched, not one hit its target. On the other hand, the Israeli speed boats, under cover of jamming rapidly approached the Syrian speed boats, at the same time launching "Gabriel" anti-ship missiles, and sunk a number of the Syrian speed boats. The main reason the superior Syrian naval squadrons lost is because they lacked ECM. The war has ended but the struggle with ECM is still intensely going on. Electronic reconnaissance aircraft and reconnaissance satellites still continue their scouting, new guidance radars are being developed, computer controlled modernized electronic combat systems are being tested, and dangerous electric waves fill the skies. But as long as ECM technology is adeptly used, disaster can still be avoided.

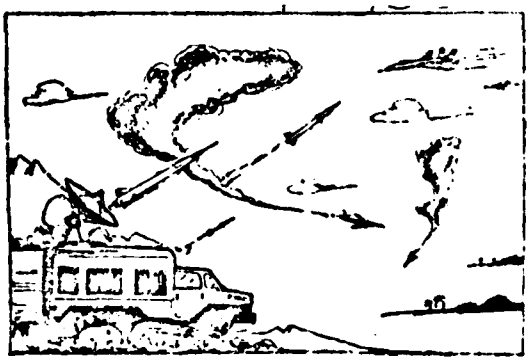

Fig. 1. Anti-aircraft "ambush" warfare

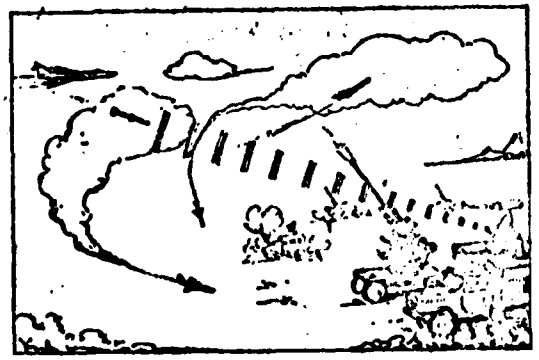

Fig. 2. Life-and-death struggle

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